US Army Corps of Engineers

Responses to Climate Change (RCC) Program

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US Army Corps of Engineers
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Outline

- Overview of Response to Climate Change Program
- Illustrations of ongoing activities:
  - Non-stationarity initiative
  - Sea-level rise adaptation
  - Vulnerability assessments
  - Adaptation for ecosystem restoration planning

Bottom Line Up Front

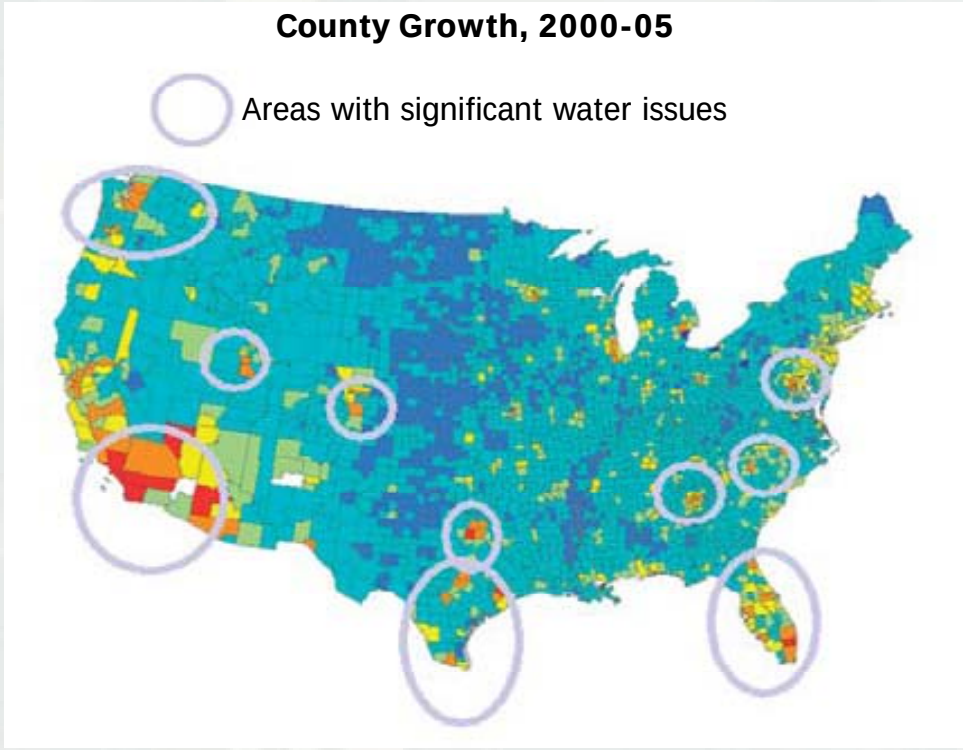
- Climate change impacts are most effectively dealt with on regional to local basis using nationally consistent, comprehensive approaches
- Though knowledge is incomplete, it is sufficient to begin adaptation measures
- USACE is developing methods that will help establish priorities and begin implementation

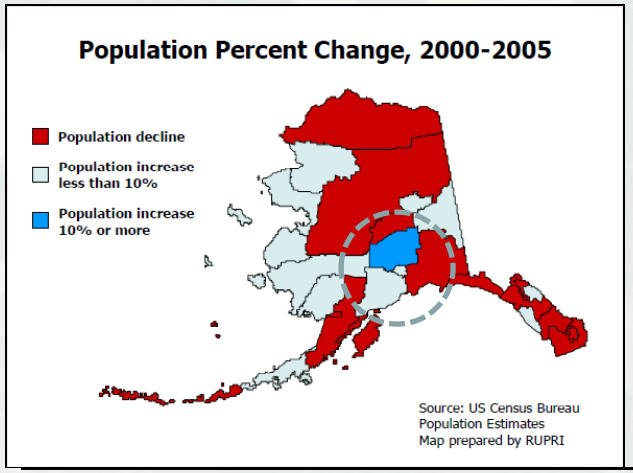
- US Ports and Waterways convey >2B Tons of Commerce
- Foreign Trade alone creates >$160 B in Tax Revenues

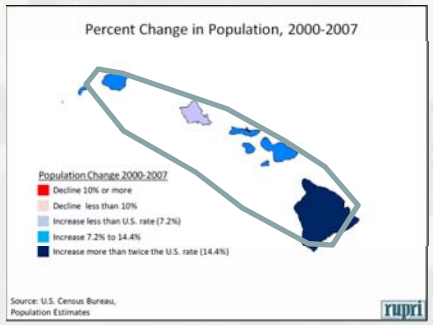
Water Resources Challenges

Demographic shifts

- U.S. population to reach 440 million by 2050
- Population more urbanized, concentrated in coastal communities at risk from severe weather and lack of fresh water

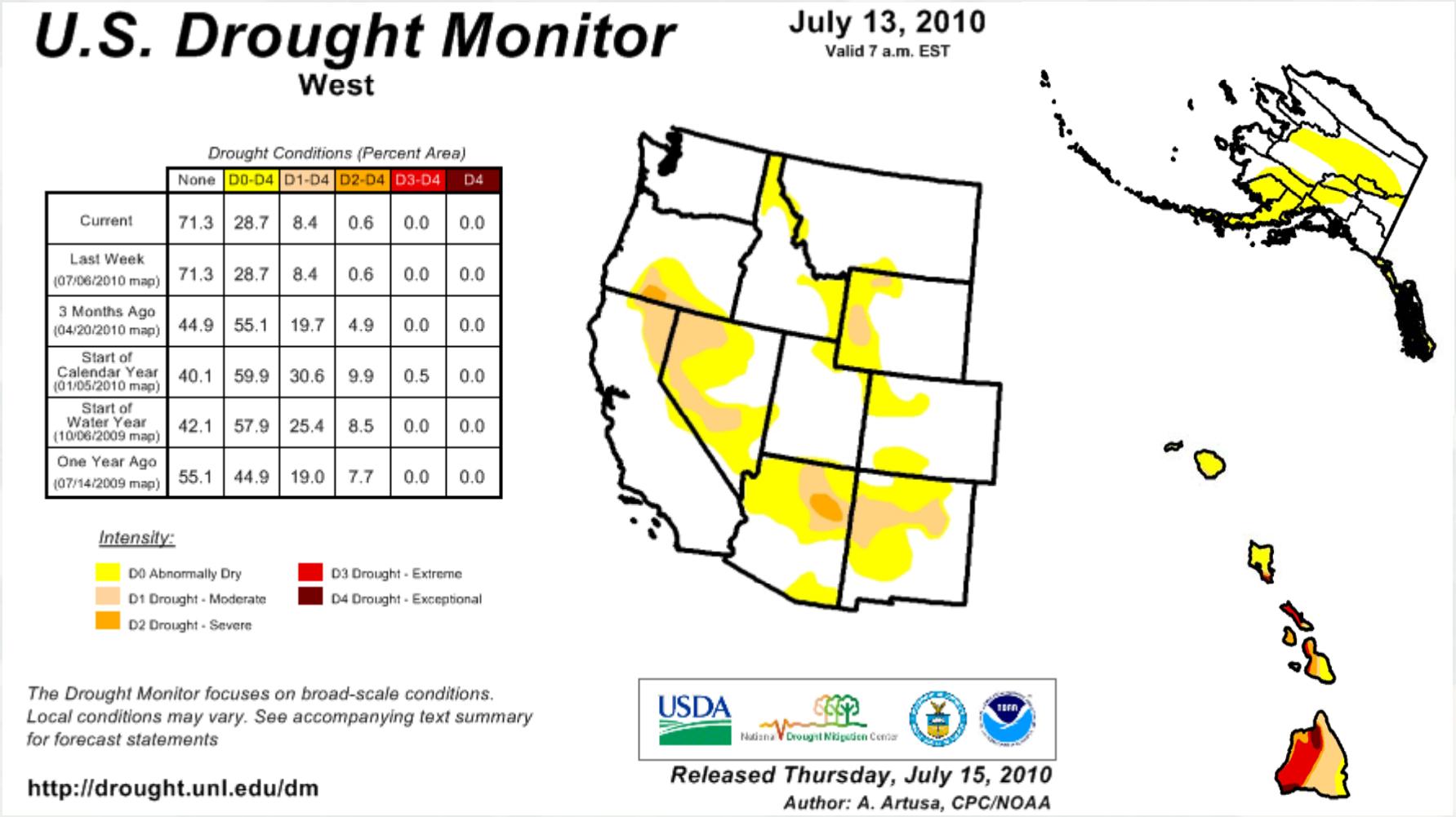






Water Resources Challenges

National Integrated Drought Information System



Water Resources Challenges

Aging Infrastructure

- ASCE overall grade of U.S. infrastructure in 2009:***"D"*** Would need $2.2 trillion to fix
- Over half of Corps locks, many other facilities, beyond 50-year "design life, need extensive maintenance & rehabilitation
- Failure poses risk to populations, economy

Globalization

- Foreign trade is increasing share of U.S. economy – could reach 30% by 2010
- Inability of ports and inland waterways to handle greater cargoes could limit economy.

Water- Energy- Food Nexus

- Development of hydropower as clean source
- Role of waterways in transport of coal, petroleum and natural gas
- Volumes of water needed for new sources

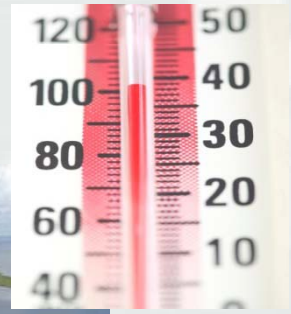
Water Resources Challenges

Environmental Values

- Pressure from increased development impacts natural environment
- Developing sustainable water resources will require cultural shift, lifestyle changes as well as technical innovation

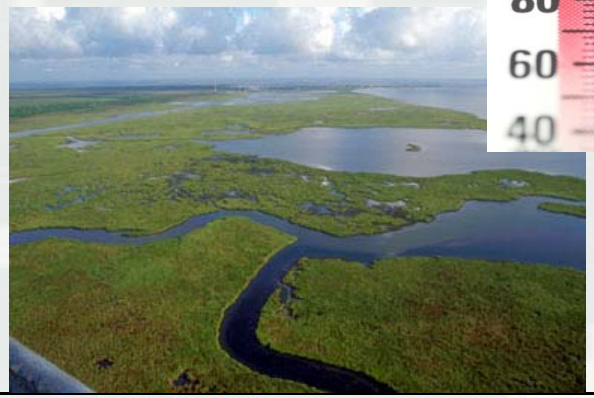
Climate Change

- Earlier spring snowmelts, river pulses seen in western U.S.
- Potential to affect all aspects of water resource management
- Likely to exacerbate water scarcities, lead to increased conflict over uses.



Declining Biodiversity

- 3 times as many freshwater species as land species lost to extinction
- Need for habitat restoration



Water Resources Challenges

Governance

- Determining proper roles for Federal, State, local and non-government entities
- Gaps in jurisdiction as watersheds cross political boundaries
- Perceived lack of national direction on water resource issues

Continued Pressure on Federal Budget

- More older people = more entitlement spending, less available for discretionary programs
- Rigorous analysis needed to ensure projects and programs are prioritized to ensure greatest value for taxpayer funds

Legislative Changes

- Changes in legislation and appropriations have major effect on how soon goals can be achieved. Uncertainty requires flexibility.

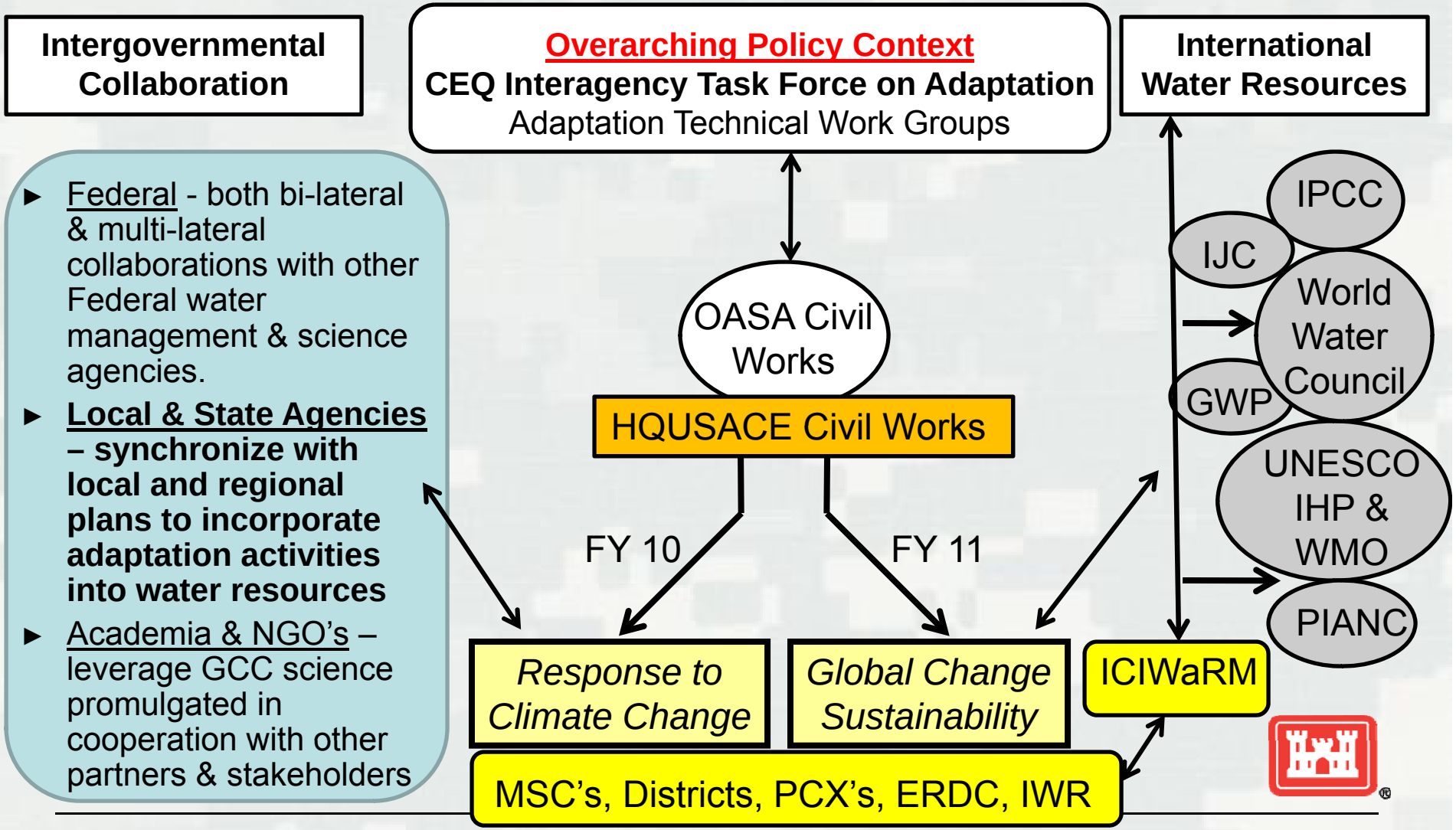
USACE Approach to Adaptation

- Collaborative
- Comprehensive
- Consider scales
- Capacity-building

Response to Climate Change Program Vision

- Nationally consistent
- Practical and cost-effective approaches
- Reduce vulnerabilities to water infrastructure
- Risk-based framework
- Collaboration with other Federal science and water management agencies, other levels of government, academia, and stakeholders.

Civil Works Climate Change Activities



USGS Circular 1331

- The four major Federal water resources agencies:

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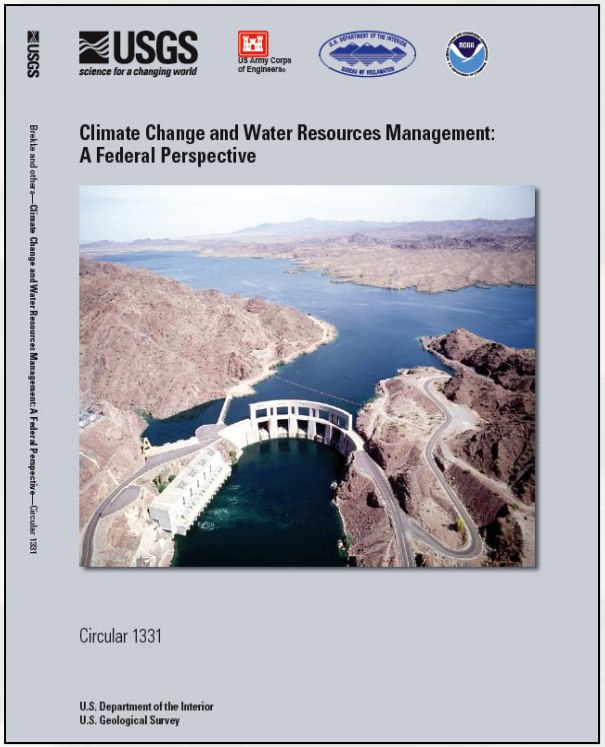
U.S. DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION

USGS science for a changing world

NOAA



- To evaluate practices of federal agencies to incorporate climate change considerations into activities related to Nation's water resources
- Provide foundation for future policies

http://pubs.usgs.gov/circ/1331/

Report released as USGS Circular 1331
February 2009

RCC Program - Three Parallel Tracks

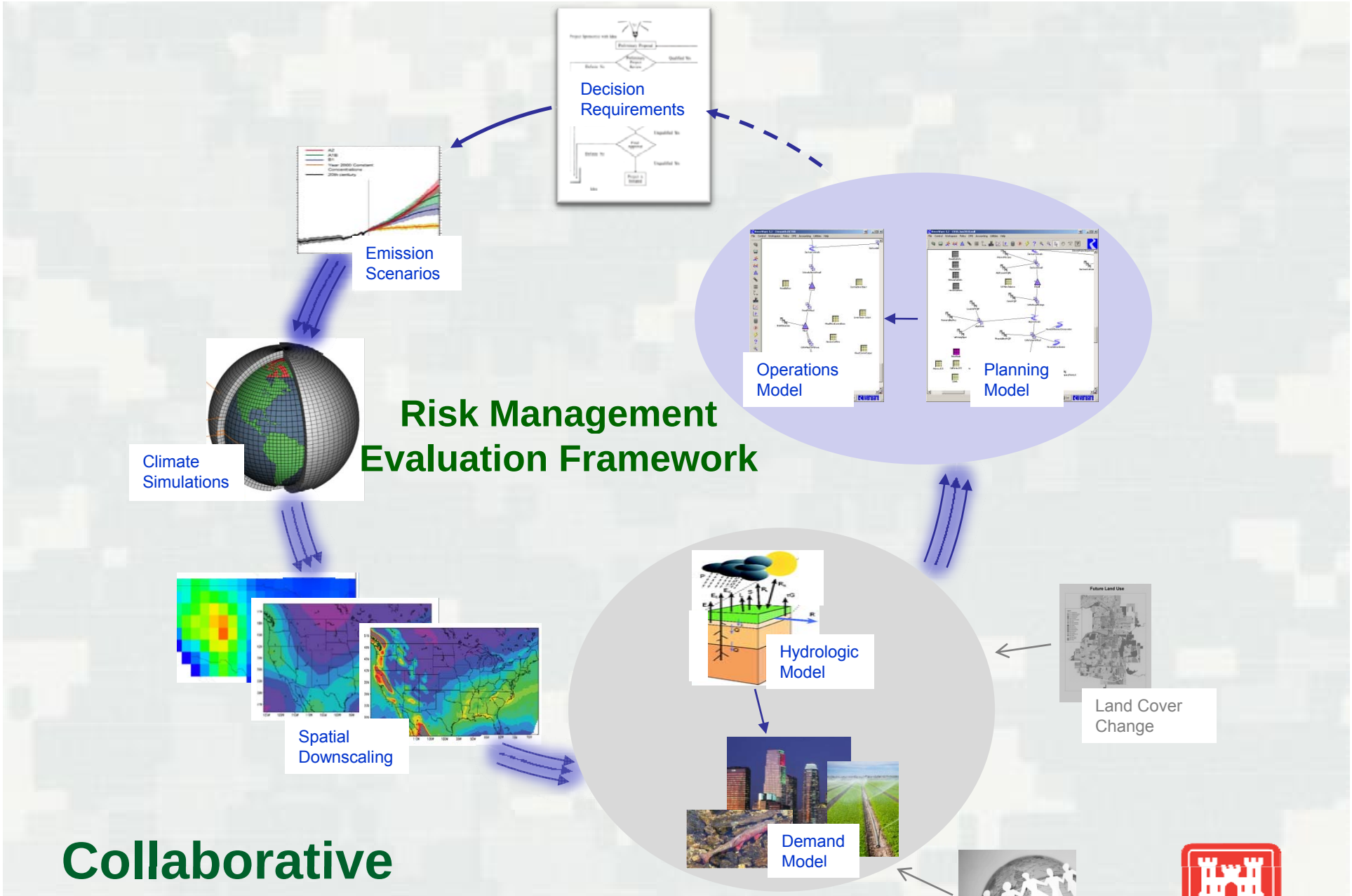
- Vulnerability "stress-tests" within the CW O&M portfolio of built and natural projects
  - Regional climate change impact assessments
- Risk-informed methods and policies
  - Water control and reservoir systems operations
  - Hydrologic frequency analysis – extreme events floods & droughts under changing conditions
  - Coastal vulnerability
  - Ecosystem restoration
  - Climate uncertainty – scenario planning
- Pilot studies – e.g., San Francisco District

Hydrology to Support Adaptation

- Enable management of hydrologic extremes due to climate variability.
- Shift from a stationary paradigm to one of constant evolution that takes into account changing physical and socioeconomic processes.
- Hydrological tools and methods are needed to ensure that USACE systems and projects remain adaptable and sustainable over time as the frequency and magnitude of extreme events change.

Non-Stationarity Workshop

- January 2010: Workshop on Nonstationarity, Hydrologic Frequency Analysis, and Water Management
- Focused on alternatives to the assumption of stationarity in hydrologic frequency analysis.



Collaborative

Climate Change and Water Working Group Workshop, Aug 2010

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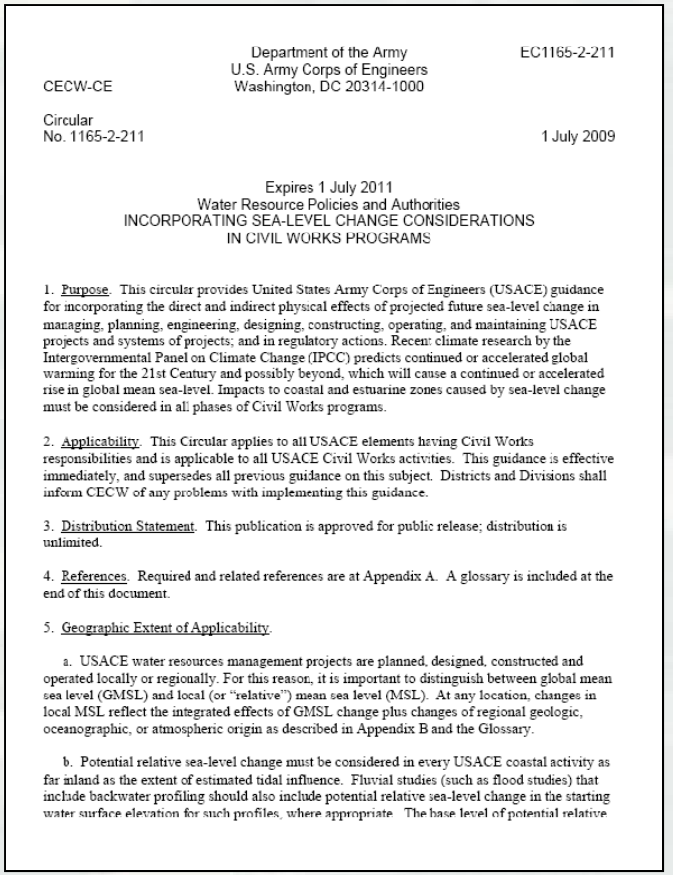
Guidance & Policy: Sea Level Change Adaptation

- Guidance released July 2009.
- Engineer Circular 1165-2-211 applies to planning, engineering, operations, and construction.
- Uncertainties:
  - How fast will ice sheets melt?
  - What is the rate of sea level rise?



Department of the Army
U.S. Army Corps of Engineers
Washington, DC 20314-1000

CECW-CE

EC1165-2-211

Circular
No. 1165-2-211

1 July 2009

Expires 1 July 2011

Water Resource Policies and Authorities
INCORPORATING SEA-LEVEL CHANGE CONSIDERATIONS
IN CIVIL WORKS PROGRAMS

1. Purpose. This circular provides United States Army Corps of Engineers (USACE) guidance for incorporating the direct and indirect physical effects of projected future sea-level change in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects; and in regulatory actions. Recent climate research by the Intergovernmental Panel on Climate Change (IPCC) predicts continued or accelerated global warming for the 21st Century and possibly beyond, which will cause a continued or accelerated rise in global mean sea-level. Impacts to coastal and estuarine zones caused by sea-level change must be considered in all phases of Civil Works programs.

2. Applicability. This Circular applies to all USACE elements having Civil Works responsibilities and is applicable to all USACE Civil Works activities. This guidance is effective immediately, and supersedes all previous guidance on this subject. Districts and Divisions shall inform CECW of any problems with implementing this guidance.

3. Distribution Statement. This publication is approved for public release; distribution is unlimited.

4. References. Required and related references are at Appendix A. A glossary is included at the end of this document.

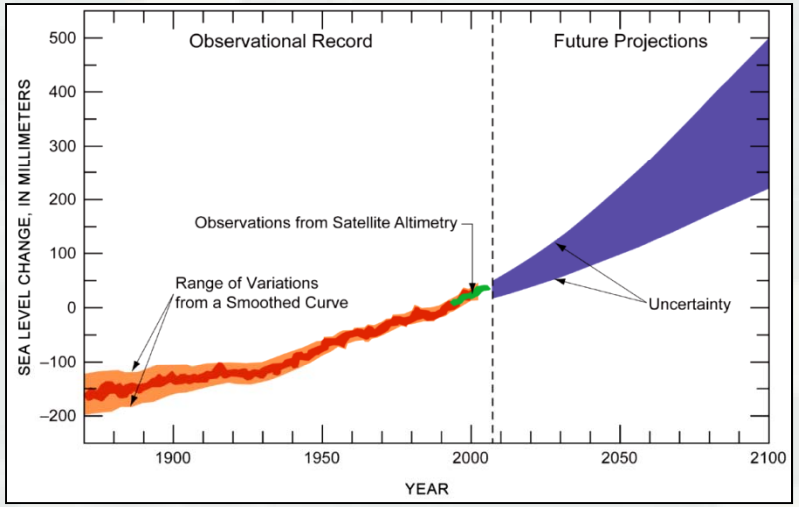
5. Geographic Extent of Applicability.

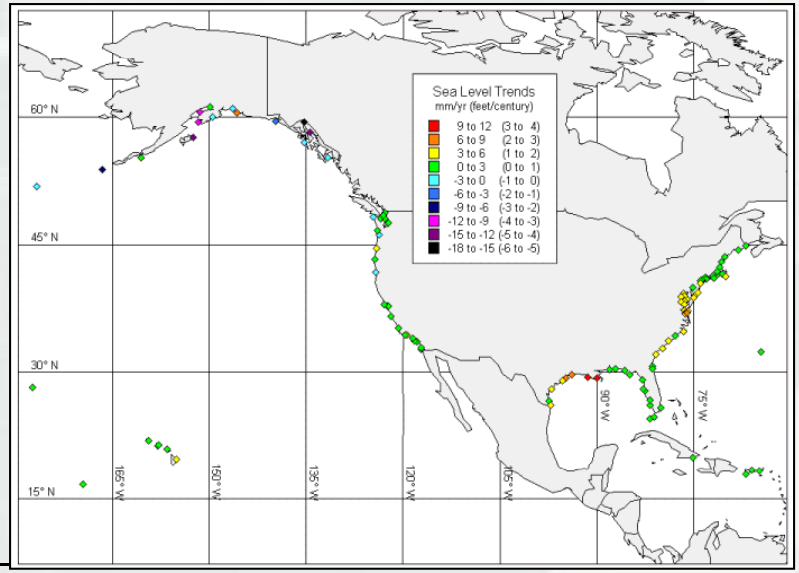
a. USACE water resources management projects are planned, designed, constructed and operated locally or regionally. For this reason, it is important to distinguish between global mean sea level (GMSL) and local (or "relative") mean sea level (MSL). At any location, changes in local MSL reflect the integrated effects of GMSL change plus changes of regional geologic, oceanographic, or atmospheric origin as described in Appendix B and the Glossary.

b. Potential relative sea-level change must be considered in every USACE coastal activity as far inland as the extent of estimated tidal influence. Fluvial studies (such as flood studies) that include backwater profiling should also include potential relative sea-level change in the starting water surface elevation for such profiles, where appropriate. The base level of potential relative

Uncertainty in Future Sea Levels: Sea-level Change & Coastal Vulnerability

- Multiple scenario approach
- Vulnerability of USACE Coastal Projects to Sea-Level Change
- Multi-agency effort
- Engineer Technical Letter
  - Guidance to inform planning and engineering studies.





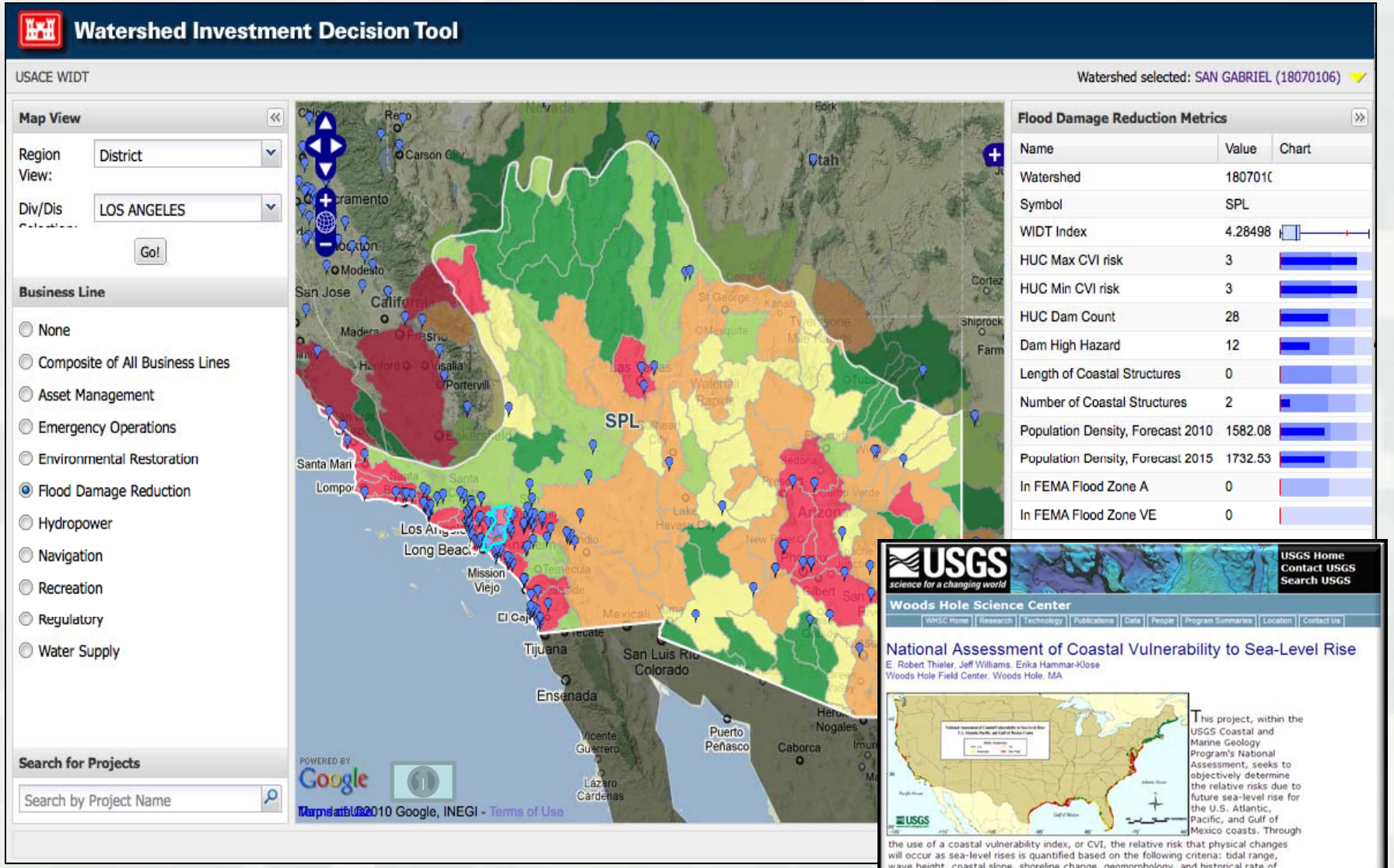
Vulnerability Assessments

- Different scales, simultaneous, not sequential
  - Regional-scale screening
    - Build on existing tools and data
    - Regional integrated business line analyses
  - Basin-level & more detailed project-level screening
    - Capitalize on current studies of at-risk projects (e.g., American River, Missouri River)
    - Developing and testing methods for adapting to climate change
- Results will drive adaptation priorities

Conducting Vulnerability Assessments

- Build on existing tools:
  - USGS Coastal Vulnerability Index (CVI)
  - US Forest Service Fire Management System
  - EPA Regional Vulnerability Assessment Tool
  - Visualize in Watershed Investment Decision Tool
- Build on existing data:
  - Program for Climate Model Diagnostics and Intercomparison (PCMDI) archive of GCM and downscaled data
- Consider where climate is changing fastest or is most severe

Watershed Investment Decision Tool



Adaption for Ecosystem Restoration

- Compilation of ecosystem climate impacts & responses (FY 10)
  - Framework for ecosystem vulnerability assessment
- Gap analysis for ecosystem restoration program (FY 10-11)
  - Work with science agencies to develop strategies to address science needs
- Guidance for consideration of climate change in ecosystem restoration projects (FY 11-13)
  - Strategic planning with partners
  - Environmental benefits, ecosystem services, and trade-off analyses
  - Risk and uncertainty, adaptive management

Global Change Sustainability (GCS)

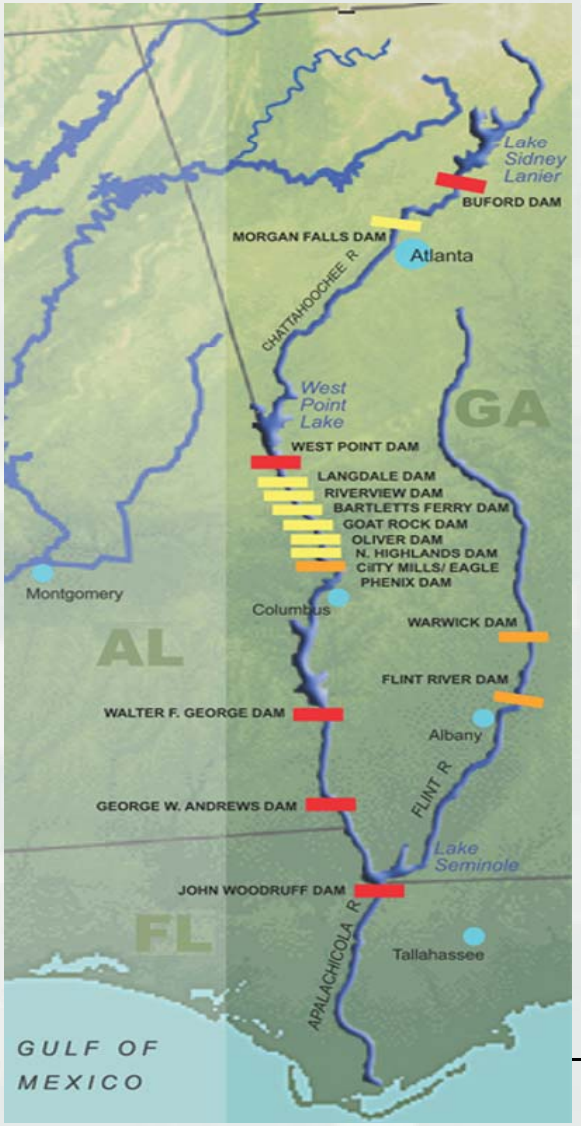
- Implement adaptation measures at USACE projects
  - Update drought contingency plans
  - Evaluate reservoir reallocation or re-operation for contemporary needs
  - Conduct Sustainable Rivers Program demonstration projects w/TNC
  - Revised frequency analysis for floods and coastal storms
  - Develop guidance for ecosystem restoration planning
- Collaborate with Federal, state and local agencies to develop management strategies for dealing with sea level change and changes in coastal storm intensity
- Address mitigation in addition to adaptation

Map not to scale!

Thank You!

Back-up Slides

NIDIS Pilot Study: Southeast-ACF Pilot



National Integrated Drought Information System (**NIDIS**) – a NOAA-led interagency effort to develop a drought information system for "better informed and more timely drought-related decisions, leading to reduced impacts and costs."

USACE participation in NIDIS pilot study will develop tools so stakeholders in the basin agree on current drought conditions.

Pilot Studies

Coastal Ecosystem Planning Study (SAJ)

Sea-Level Change Planning Study (SPN)

Multipurpose Reservoir – O&M: Flood, fish & wildlife, water quality, water supply, recreation, leveraging UNESCO

Beach Renourishment – CG (NAD)

Multipurpose Reservoir – Basin approach to drought planning (SAM)

Procedures to Evaluate Sea Level Change Impacts, Responses, and Adaptation

Engineering Technical Letter Team

External Experts
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FHWA
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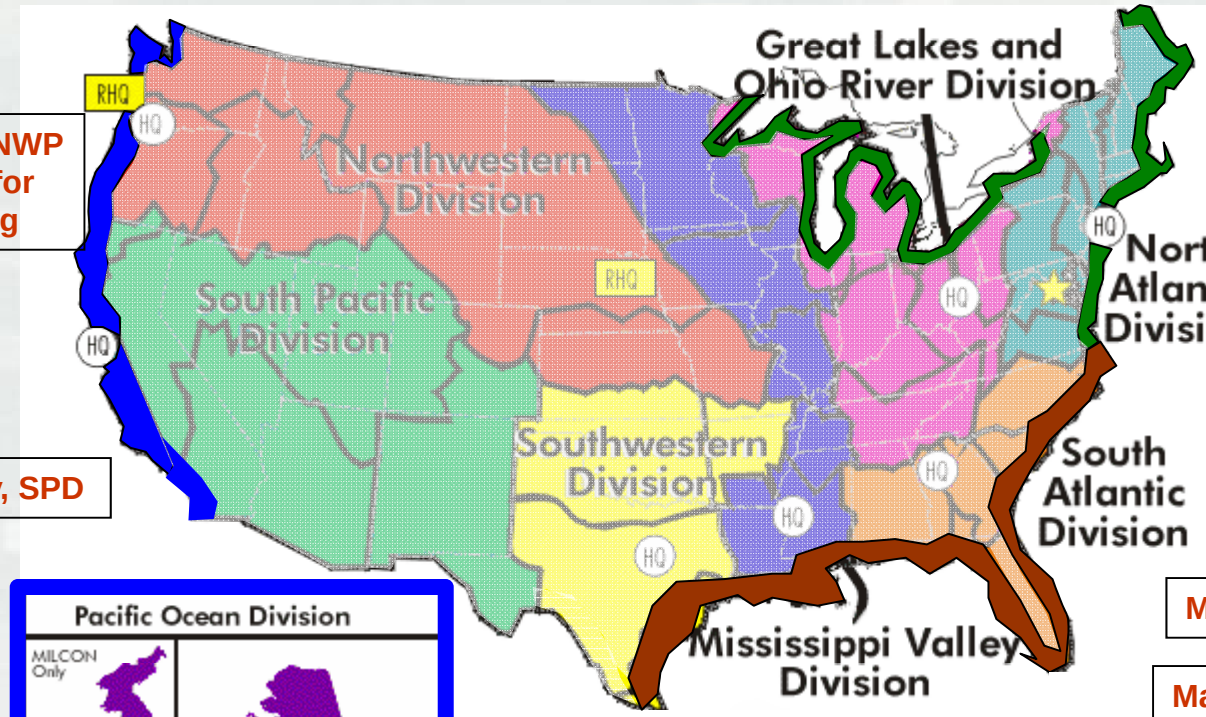

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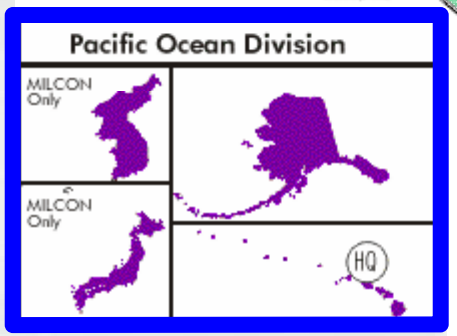

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Global Change & Sustainable Development: Risk Management Framework